CUSTOMER ROLES IN SERVICE SUPPLY CHAINS AND OPPORTUNITIES FOR INNOVATION

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This article conceptualizes service supply chains according to the Unified Service Theory, which defines services as bidirectional supply chains that have customers both providing resources to and receiving resources from service providers. We establish how eight traditional roles in manufacturing supply chains are assumed by customers in service supply chains. Those service–customer roles include component supplier, labor, design engineer, production manager, product, quality assurance, inventory, and competitor. We describe how these eight roles are manifested in both business-to-consumer and business-to-business service contexts. We confirm the distinctiveness of these eight customer roles through an initial empirical study and show how the roles are manifested across different types of services. We then demonstrate how these distinctive customer roles can form the basis for service supply chain innovation.

Keywords: *service supply chains; service purchasing; behavioral supply management; unified service theory*

INTRODUCTION

The premise of this article is that service supply chains (SSCs) are structurally and managerially distinct from manufacturing supply chains, as manifested in various customer roles within those supply chains. The foundation of this premise is the Unified Service Theory (UST), which posits that the fundamental distinguishing characteristic of "services" is that they possess bidirectional supply chain relationships wherein customers are also suppliers (Sampson 2000; Sampson and Froehle 2006). In SSCs, customers supply some combination of input materials, labor, specifications, and so forth. This implies that SSC customers assume expanded roles beyond the traditional customer roles in nonservice supply chains.

We will introduce the customer roles by analogy, reviewing essential noncustomer roles that occur within manufacturing supply chains and showing corresponding customer roles that occur in SSCs. As a practical application, we will show how managing various customer roles in service supply chains can lead to opportunities for service innovation.

The next section reviews major roles in manufacturing supply chains, followed by a section that shows parallel customer roles in SSCs as documented in the literature. We verify the SSC customer roles through an empirical study. We demonstrate how the customer roles are manifested differently in different types of services, using common service typologies from the literature. The penultimate section demonstrates how the expanded customer roles lead to opportunities for innovation. The final section summarizes.

MAJOR ROLES IN TRADITIONAL SUPPLY CHAINS

Manufacturing[1] supply chains can be complex structures involving many players who assume various roles. In fact, the discipline of supply chain management largely involves identifying and coordinating the roles of the various entities. A typical manufacturing supply chain will involve the following roles:

[1]In this article, we sometimes refer to "manufacturing" as the opposite of service, but also acknowledge that some manufacturing is a service, such as contract manufacturing or custom manufacturing (Sampson 2001, p. 154). The precise service juxtaposition is make-to-stock manufacturing under a push production paradigm.

1. Suppliers — supply input materials and components.
2. Labor — provides the human effort in production.
3. Engineering — provides design specifications for products and processes.
4. Production — executes productive processes.
5. Product — the object of production.
6. Quality assurance — assures the quality of inputs and production.
7. Inventory — buffers rate gaps between stages of production and between production and demand.
8. Competitors — motivate the focal firm to improve performance.
9. Customers — select and pay for production output.

This list of roles is, of course, not exhaustive, but it is sufficient for our study. These roles occur at various stages throughout traditional supply chains, and in some cases, the roles may overlap. However, in traditional supply chains, the final role, customers, is generally distinct from the other roles:

1. Suppliers are upstream; customers are downstream.
2. Labor works within the focal firm; customers are exogenous.
3. Engineering is the function of trained engineers.
4. Production is often shielded from customers.
5. Products are what customers ultimately receive.
6. Quality assurance keeps defective products from reaching customers.
7. Inventory can be used to satisfy customer demand in a timely manner.
8. Competitors provide customers with choice.

In traditional manufacturing supply chains, the customers — end consumers in particular — are beneficiaries of the various supply chain roles but are only responsible for selecting, paying for, and using the outputs. In some cases, customers provide feedback that can be used for future production, or they may assume a marketing role by providing word-of-mouth recommendations to other prospective customers.

Although customers *may* assume expanded roles in traditional supply chains, we hypothesize that customers *do* assume expanded roles in SSCs. We may go so far as to posit that expanded customer roles as a defining feature of SSCs. In the next section, we will review how this concept has been discussed in the research literature and will subsequently provide empirical evidence of this SSC distinction.

SSC CUSTOMER ROLES DESCRIBED IN RESEARCH LITERATURE

Research has suggested that the most distinctive feature of service supply chains is the breadth of customer involvement (Mersha 1990; Nie and Kellogg 1999). The UST provides a conceptual basis for that involvement (Sampson 2001). The UST defines "services" as "bidirectional supply chains" that require customers to provide essential resources to service providers before the service providers are able to operate and meet customer needs (Sampson 2000), as depicted in Figure 1. Service providers can prepare for service independently but cannot actually perform service processes until the appropriate customer resources are received (Sampson and Froehle 2006).

The UST characterizes customer-provided resources as the customer's self (including mind, body, and effort), belongings, or information (including service specifications) (Sampson 2010a). The customer-input requirement has various implications for SSCs, including (Sampson 2000):

1. SSCs are generally short, as customer resources have to travel in two directions.
2. Service providers typically do not pay for customer-provided resources.
3. Service providers inherently produce JIT (just-in-time), as the dependency on customer resources precludes producing the service to inventory.
4. Services include implicit customer expectations for the value added by the service provider, as the customer sees both ends of the service process.

The major claim of the UST is that all managerial issues that are unique to services and SSCs are founded in the customer-as-resource-supplier distinction (Sampson 2010b), including issues relating to strategy, production planning, quality management, and so forth (Sampson and Froehle 2006).

Figure 1 shows a dyadic SSC, with the focal firm having a bidirectional relationship only with immediate customers but with the other supply relationships acting as a traditional unidirectional supply chain. More complex SSCs exist, wherein a focal firm may have bidirectional relationships with more complex combinations of customers and suppliers.

FIGURE 1
Traditional Linear Supply Chain versus Bidirectional SSC

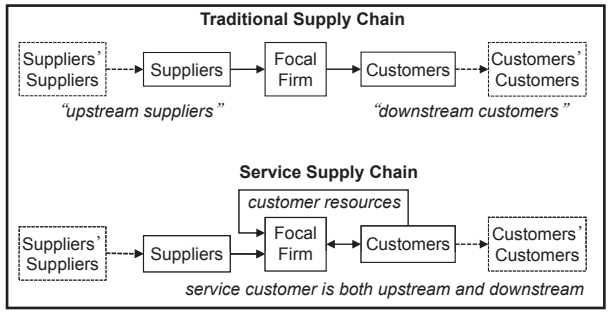


FIGURE 2
Multi-entity SSC Examples

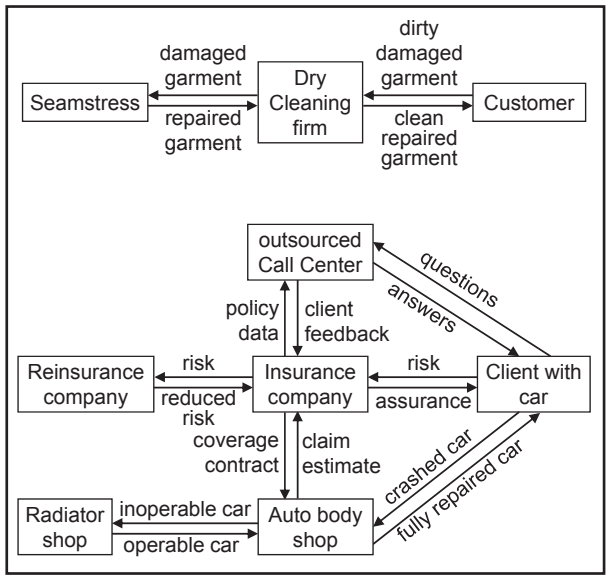


Figure 2 shows two examples involving dry cleaning and auto insurance. The dry cleaning example is what Sampson (2000, p. 352) calls a "two-level bidirectional supply chain." In that example, the dry cleaning firm receives a damaged garment from a customer, but outsources the repair of garments to a seamstress.

The auto insurance example shows a more complex SSC, what Normann (2001) would call a "service constellation." An insurance client (an individual or a firm) owns a car. The client provides the insurance company with risk that is characterized by the value of the car, the age and accident record of the driver, and so forth. The insurance company provides the client with assurance of mitigated risk. Insurance companies often employ reinsurance companies to take on some of the aggregate risk. Clients with questions about insurance coverage may call a company phone number that is routed to an outsourced call center. If the client has an auto accident, the client will likely go to an auto body shop that has contracted to do repairs on behalf of the insurance policy. Auto body shops do not usually do mechanical repairs, but outsource mechanical repairs to specialists like radiator shops.

These examples illustrate the generality of the UST across business-to-business (B2B) and business-to-consumer (B2C) SSCs of various complexities. This article builds on the UST by first enumerating specific inputs that customers provide in SSCs, thereby identifying customer roles that are manifested in SSCs. We subsequently demonstrate how those customer roles can be used as the basis of service innovation. Our intention here is to set out the implications of each of these customers' roles in SSC relationships. At the same time, we understand that defining limits to a supply chain, or Normann's "service constellation," is a matter of judgment, depending on our purpose. As such, most extended supply chains sooner or later comprise service and manufacturing elements, and we begin to examine these more complicated combinations later in the paper. First, however, we will begin by reviewing the research literature relating to SSC customer roles that correspond to the eight generic supply chain roles listed in the prior section.

1. SSC Customers as Component Suppliers

In a highly cited article, Lovelock (1983) generically classified services based on what customer components the service provider acts upon. His four categories of services are as follows: (1) services that act on customers' minds (e.g., education); (2) services that act on customers' bodies (e.g., healthcare); (3) services that act on customers' physical possessions (e.g., television repair); and (4) services that act on customers' information (e.g., tax accounting). This classification scheme implies that *service customers are component suppliers* (of their minds, bodies, belongings, or information) to service businesses.

The "customer as component supplier" phenomenon occurs with B2B services as well as B2C services. Buildings are supplied as essential inputs to building cleaning services. Business problems and data are supplied as inputs to management consulting services. Copy machines are an essential input to copy machine repair services.

As suggested earlier, in traditional make-to-stock manufacturing supply chains (e.g., top of Figure 1), customers are customers and suppliers are suppliers. In particular, individual end consumers do not provide any distinct components to be used in the manufacturing of their products and likely do not even know where or when the products were produced. If a manufacturer starts producing items based on each specific customer's specifications (i.e., custom manufacturing), the manufacturer transforms, to some degree, into a service process (Sampson 2001, p. 142).

2. SSC Customers as Labor

One service customer role that has received a large amount of attention in the literature is *co-production*, wherein service customers serve as labor to assist in the production of the service (Grönroos 2008). Service customers have been called "partial employees," indicating that they assume some — but not all — functions of regular employees (Mills and Morris 1986; Schneider and Bowen 1995; Xue and Harker 2002). A B2C example is the common practice of customers filling their own drinks at fast food restaurants. The large pharmaceutical distributor McKesson provided a B2B example when they installed computer terminals

in client pharmacies, allowing pharmacists to check the availability of medicines without having to talk with a McKesson employee. Another perspective on customer labor is that some of the labor requirements of service firms are "outsourced" to customers, indicating a role shift (Sampson 2012).

Bitner, Faranda, Hubbert and Zeithaml (1997) delineate two manifestations of customer–labor effort. First, they indicate that customers are productive resources, contributing to the productivity of the firm. Second, they describe how customers contribute to their own satisfaction and value, regardless of whether they have contributed to the productivity of the organization. Obviously, the ideal situation is when both can be achieved.

One example of how customer labor can benefit both service providers and customers is through the use of self-service technologies, which enable customers to perform functions previously assigned to regular employees (Froehle and Roth 2004). Self-service is becoming increasingly common in many service businesses. Banks have shifted from tellers handling transactions to customers using ATMs. Airlines provide incentives for customers to manage their own check-in online. Retailers are increasingly providing self-check-out stations in place of human cashiers. Despite the costs of learning to use a self-serve system, customers benefit through increased efficiencies and, in some cases, increased control of the process.

3. SSC Customers as Design Engineers

Customer focus groups may give general ideas to make-to-stock (push production) manufacturing organizations about product design, yet, with the exception of large-scale industrial customers, *individual* customers have little influence over product design. Production timing and required production efficiencies make it impractical for individual customers to participate in manufactured product design in most instances. It is even rarer for customers to influence manufacturing *process* design, as most customers have little or no knowledge of the intricacies of suppliers' manufacturing processes.

Chase and Aquilano (1995, p. 104) paint a very different picture for services: "Everyone is an expert on services. We all think we know what we want from a service organization and, by the very process of living, we have a good deal of experience with the service creation process." The implications of this supposed "customer expertise" is that service customers are very likely to have strong opinions about how the service should be designed, including opinions about the process by which it should be delivered. Some have espoused actively involving customers in new service development (NSD) activities (Lundkvist and Yakhlef 2004; Matthing, Sanden and Edvardsson 2004).

Customers act as design engineers in SSCs from a wide variety of industries. Oliveira and Von Hippel (2011) show how much of the innovation occurring in commercial and retail banking between 1975 and 2010 came from customers. When the insurance company depicted in Figure 2 outsourced the call center function, they certainly provided detailed specifications about how calls are to be handled. Van der Valk and Rozemeijer (2009) stress the importance for the buying firm of identifying and communicating end customer demands in this kind of situation. B2C examples are also common. Hair salon customers may be expected to specify the design of the finished product (i.e., hairstyle) and sometimes even the process (e.g., "use #3 clippers"). With the advent of "discount brokers" such as Charles Schwab and E*Trade, customers design their own investment portfolios. Even SSCs as complex as healthcare involve some degree of customer-led process design, as patients help configure treatment plans that fit their needs, capabilities, and resources.

Sometimes customer expertise may not be justified, such as a customer presenting service design ideas that are unreasonable, are against regulations, damage the cost structure of the firm, or otherwise cannot be implemented (Fitzsimmons and Fitzsimmons 2006, p. 204). In other cases, customers may have better design ideas than the service employees themselves, owing to experience with the service and other service providers. Either way, when a customer presents design ideas to a service provider, that customer is assuming the role of a design engineer (Dubé, Johnson and Renaghan 1999). Such customer involvement may be desirable or undesirable; either way, it is a reality.

4. SSC Customers as Production Managers

In manufacturing, after products and the production process are designed, it is still up to the production manager to execute the process and create the products. Production managers receive direction from engineering and make decisions about when to produce specific items and in what quantities. Manufacturing production managers typically base decisions on demand forecasts, inventory levels, and orders in hand, but otherwise seldom interact with customers (Frei 2006).

Again, we see an SSC distinction. As Namasivayam and Hinkin (2003, p. 27) state, "In contrast to manufactured goods where the consumer makes choices from products being offered and has no control of the products themselves, the service product is created during the service encounter, under the direction of the customer." In other words, to some degree, service customers assume a role of production manager, directing, and influencing some aspects of the

supplier's activities and, in some instances, influencing the behavior of other customers.

In a B2B context, there are many instances, for example, cleaning services or facilities maintenance, where the service activity is carried out by an external provider, but the exact day-to-day direction of what is done when is under the control of the customer's management. This might be because the service provider's work needs to be arranged for the short-term convenience of the customer. A B2C example is the role parents assume in executing their families' visit to an amusement park like Disneyland. Disneyland is in essence a configuration of specialized workstations including rides, shows, and food outlets. Parents are responsible for managing the flow of their products (children) through the various workstations, striving to maximize productivity, and avoid significant bottlenecks.

In some cases, customers may attempt to alter the service delivery to their liking. Even when customers fully comply with standard operating procedures, they still may make key operating decisions, such as the pace of the service and amount of attention to details. For example, in retail, customers determine how much time they spend in the facility, what types of questions they ask employees, how much knowledge they require to make a purchase decision, and so forth.

5. SSC Customers as Products

In the case of so-called human services, *customers are the actual product* (Lengnick-Hall 1996, p. 796). This pertains to Lovelock's first two categories of services: those that act on customers' minds and those that act on customers' bodies (Lovelock 1983). In some situations, the customer-product also has some control over the production process, such as in education and healthcare. In other situations, the customer-product is the passive recipient of processing, such as mass transit. Although the product of mass transit may be defined as "transportation systems for public use," ultimately the product that customers pay for is "customers delivered to their desired locations." In other words, the bus/train/plane is not the product — the customer is the product.

The customer-as-product effect is also seen in B2B services. For example, a firm may employ an investment banking service to orchestrate an initial public offering (IPO). The investment bank may provide legal direction and underwrite the offering, but ultimately the "product" of the IPO is the firm itself that is being sold to investors. And firms frequently engage management consultants to implement new approaches such as six sigma or to restructure the organization: in a sense, this is also analogous to the "human services" discussed in a B2C context, as the restructured firm has been acted on by the service provider.

6. SSC Customers as Quality Assurance

It is an unfortunate fact that not all students manage the production of their education and not all patients manage their health in ways that allow optimal education or healthcare service quality. On the other hand, *service customers can and often do assume an active role in quality assurance*. Service customers provide specifications of quality. They measure and judge quality (Chervonnaya 2003). Instead of measuring products or processes, service quality is primarily measured by customer feedback (Parasuraman, Zeithaml and Berry 1985; Sampson 1999; Lengnick-Hall, Claycomb and Inks 2000, p. 360).

The prevalence of customer comment cards used across many B2C industries indicates the role of customers in quality *control*. But the role may extend beyond this, to include quality assurance and quality management (Dale, 2003). The quality of a student's experience in a class can be assured — to some degree at least — by their reading and preparing for the class. In B2B, customers are often heavily involved in controlling, assuring, and managing service quality, including intervening in and directing their suppliers' activities of service delivery. A critical issue in this is the extent to which the specification and associated performance indicators emphasize the supplier's input, process, output, or outcome (Axelsson and Wynstra 2002, pp. 143–144), suggesting different quality management roles for the customer.

The service customer role of quality assurance pertains not only to *what* service outcome is delivered but also *how* it is delivered (Kelley, Donnelly and Skinner 1990). Service customers often have an active role in both process and outcome quality (Webb 2000). For example, a business owner may hire an accounting firm to conduct an audit of financial records. The accuracy of the records certainly will influence the outcome of the audit. The organization and completeness of the records will influence how well the audit process progresses. The business owner desires an audit that is defensible and also desires the audit process to go smoothly — the former representing outcome quality and the latter representing process quality.

7. SSC Customers as Inventory

Customer evaluations are not just about service quality, but also about process efficiency. Customer interaction has been cited as the primary cause of inefficiency of service operations (Chase 1978, 1981), yet research has shown that customers value efficient service. As noted by Xue and Harker (2002, p. 254), "in terms of judging the efficiency of service delivery,

a consumer often makes this judgment based not only on how long it takes the firm to complete its portion of the process but also on how efficient the consumer views the use of their resources, especially their time, to complete the service process." Customers do not want to be kept waiting before, during, or after the service delivery.

The primary reason customers are kept waiting in a service is because service capacity is insufficient and customer inputs arrive before the server is ready to handle those inputs; this same phenomenon causes inventories to occur in manufacturing supply chains (i.e., goods arrive before the system is ready to process them) (Chopra and Meindl 2001, p. 52). Indeed, *service customers are often inventory*, waiting for themselves, their belongings, or their information to be processed. For example, airlines are customers of airports, paying landing fees to use the airport's runways and facilities. They perform the role of inventory — or at least their aircraft do — when they are held in a holding stack awaiting an available runway at the airport. Some inventory of this type allows the airport to maximize utilization of its capacity, but excessive delays may lead to customer dissatisfaction and defection.

Fitzsimmons and Fitzsimmons (2004, p. 428) describe various ways in which customer waiting is analogous to manufacturing inventories. Both incur holding costs, although the former is usually measured in minutes and the latter measured in months. Both require a storage location, although customer inventory may require more comfortable facilities than physical goods inventories. And both are an outcome of inadequate capacity planning, scheduling, and coordination. "Inventory management" in services includes deciding how to deal with excessive waiting, which includes psychological dimensions (Maister 1985).

8. SSC Customers as Competitors

With traditional supply chains, customers select from among competing firms (or from among the products of competing firms). With SSCs, *the customer is often the competitor* (Bitner et al. 1997). This phenomenon is a form of service disintermediation, in that customers process their inputs without passing them through a service provider. The concept has also been called "internal exchange," wherein individuals or organizations satisfy their own needs without relying on an outside supplier (Lusch, Brown and Brunswick 1992). Examples are numerous in both B2C and B2B settings: carwash customers can wash their own cars, business consulting clients can solve their own problems, airline passengers can go by automobile instead and drive their own vehicles, and so forth.

Various reasons can motivate a customer to internally exchange. As just discussed, using a service provider may involve unacceptable waiting. A customer may feel he or she has sufficient time and expertise to "do it yourself," may value the control that comes with self-service and may receive cost-saving benefits (Lusch et al. 1992). For businesses, internal exchange may bring similar benefits, especially if the exchange involves a good or service that is strategic to the firm.

In manufacturing supply chains, the customer-as-competitor phenomenon is manifested by manufacturers that vertically integrate, thus eliminating the need for one or more suppliers. At the consumer level, customers seldom compete with manufacturing suppliers. Manufacturers dominate consumer-competitors through major barriers to entry, including economies of scale, experience curves, access to the best sources of inputs, and so forth (Porter 1980). In developed economies, it rarely makes economic sense for consumers to build their own goods when those goods are otherwise mass produced. (This is true for simple goods like pencils and complex goods like automobiles. A possible exception is foodstuffs — yet in developed countries few people grow their own food; instead they rely on food supply chains for components.)

With services, internal exchange is a viable option both for businesses and consumers. A primary reason for this viability is that the barriers to entry are lower, owing to customer involvement in service delivery processes: customer involvement makes services quite heterogeneous, reducing economies of scale; customer involvement leads to customer expertise, as discussed previously; customers are suppliers of inputs to services and thus have direct control over those inputs; and so forth (Sampson 2001, p. 230).

Customer Roles Less Distinctive to SSCs

Various authors have identified *marketing as a customer role* in service businesses (Armistead 1986; Normann 2000; Chervonnaya 2003, p. 352). Yet, the marketing role of customers is clearly not limited to service businesses but occurs in manufacturing supply chains as well. Word-of-mouth marketing is influential for goods and services, although perhaps in different ways.

As suggested in the prior section, the standard customer role of *consumer* includes selecting, paying for, and consuming the supply chain output (Lengnick-Hall 1996; Lengnick-Hall et al. 2000). Again, this role will be manifest for manufacturing supply chains and SSCs, although perhaps in different ways. For example, the selection process may differ owing to the dominance of "search" properties for goods versus "experience" properties for services (Nelson 1974; Zeithaml, Bitner and Gremler 2006). Service pricing is

often more complex than traditional manufacturing pricing, as illustrated by yield management and other services pricing techniques (Kimes 1989; Lovelock and Gummesson 2004, p. 35). And consumption often begins at the time of service production, whereas consumption of manufactured goods usually happens well after production (Fitzsimmons and Fitzsimmons 2006, p. 23).

Table 1 summarizes supply chain roles and service counterparts as just described. It shows how various service customer roles have been referred to in different ways in the literature. Some authors have sought to attribute unique names to service customer roles. For example, Chervonnaya (2003) labels customer labor "Janus" after a mythical god with two faces. An advantage of the role labels in the first column of Table 1 is that they are all titles that would be well understood by anyone familiar with traditional supply chains.

Are the Expanded Customer Roles Distinctive to SSCs?

With the exception of "customer as marketer" and "customer as consumer," one might wonder if the expanded customer roles just discussed are distinctive to SSCs. Lengnick-Hall (1996, p. 802) points out that, at least in theory, service customer roles such as "resource supplier" and "co-producer" could be assumed by customers of manufacturing organizations. However, in practice this rarely happens, for several reasons.

First, while some level of customer involvement is a defining characteristic of all service organizations (Sampson and Froehle 2006), it is a management decision *option* for manufacturing organizations (Lengnick-Hall 1996, p. 817). "Manufacturing firms typically have used their option of creating distance between themselves and customers to buffer core technologies," (Lengnick-Hall 1996, p. 798). It is clear that customer roles can impose costs in quality and inefficiency, which manufacturers may want to avoid (Lengnick-Hall 1996, p. 799; Frei 2006).

Second, as suggested previously, when manufacturing organizations involve customers in the production and delivery of manufactured goods, those organizations take on characteristics of service businesses. In other words, when a traditional make-to-stock manufacturing operation starts to actively involve customers in production processes, to some degree it ceases to be a traditional make-to-stock manufacturing operation (Bowen, Siehl and Schneider 1989). Nevertheless, in customized manufacturing, there are certain parts of the process (e.g., product design) where the customer is involved, and others (e.g., repetitive production of high-volume custom parts) where they are not (Spring and Dalrymple 2000). By examining nonmake-to-stock manufacturing firms using the eight customer roles, a more fine-grained insight may be obtained into various aspects of their operations.

Hypotheses

Even though the eight supply-chain roles enumerated above may occur in all supply chains, we hypothesize that customers assume those roles to a greater degree in supply chains that involve businesses that are considered to be service businesses. Hypotheses for the eight roles are as follows:

Customers are perceived to assume the:

H1: supplier,
H2: labor,
H3: design engineer,
H4: production manager,
H5: product,
H6: quality assurance,
H7: inventory, and
H8: competitor

role to a greater degree with businesses that are perceived to be services. We tested this set of hypotheses through a survey experiment involving consumer-customers.

EMPIRICAL VALIDATION OF PERCEIVED SSC CUSTOMER ROLES

To test the hypotheses, we developed a survey involving multi-item scales for each of the eight roles (scale items shown in Appendix A). To maximize generalizability of this study, we needed to consider a wide variety of businesses. For this initial study we considered primarily B2C services that would be familiar to most consumers, allowing us to get a large response sample based on relatively simple customer–supplier dyads in a wide range of B2C sectors. B2B services can be more complicated and often have a greater multiplicity of touch-points between customer and supplier. While our purpose is to propose that analysis of customer roles is important and useful in B2B and B2C settings, we develop the principles using the simpler B2C context, in the expectation that they can then, in future research, be tested, extended and adapted in the richer context of B2B links in SSCs.

The survey respondents, a convenience sample of college students, were asked about perceptions of customer roles regarding one of 72 different businesses described in Appendix B. Those familiar with the UST will recognize that it emphasizes that service is a process phenomenon, and that even though the classification of businesses and industries is technically imprecise, it is conceptually common (Sampson and Froehle 2006). The list of candidate businesses used in this study is somewhat arbitrary, but developed to

TABLE 1

Manufacturing Supply Chain Roles Assumed by Service Customers

Supply Chain Role	Basic Function of Role	References to Service Customers Assuming the Role
1. Component supplier	Provide essential process components	"Resource" (Lengnick-Hall 1996) (Graf 2007) "Productive resource" (Bitner et al. 1997) "Ingredient" (Chervonnaya 2003) "input supplier" (Sampson 2001)
2. Labor	Provide production effort	"Co-producer" (Lengnick-Hall 1996, p. 801; Lengnick-Hall et al. 2000; Normann 2000) "'Partial' employee" (Morris and Johnston 1987; Kelley et al. 1990; Xue and Harker 2002) "Participant" (Kelley et al. 1990; Broderick and Vachirapornpuk 2002) "Outsourc[ing] the service to the customer" (Xue and Harker 2002) "Human resource" (Graf 2007)
3. Design engineer	Design products and production processes	"Engineer" (Dubé et al. 1999, p. 306) Providers of "guidance, ideas, and technical Assistance" (Lengnick-Hall 1996, p. 795) "Development" (Normann 2000) "Lead users" (Von Hippel 1986) "Selector of specification" (Swan, Bowers and Grover 2002)
4. Production manager	Plan and execute the conversion of inputs into outputs	"Formulator of the service product" (Namasivayam and Hinkin 2003) "Instructor" (Chervonnaya 2003) "Co-developer" (Graf 2007)
5. Product	Be the object of production	"Product" (Lengnick-Hall 1996, p. 812; Lengnick-Hall et al. 2000) "Process customer body or mind" (Lovelock 1983) "Operand resource" (Constantin and Lusch 1994)
6. Quality assurance	Assure that quality is acceptable	"Quality control" (Normann 2000) definer of "the standard for quality" (Vargo and Lusch 2004, p. 333) "Contributor to quality, satisfaction, and value" (Bitner et al. 1997) "Arbiter of quality" (Lengnick-Hall 1996, p. 793) "Auditor" (Chervonnaya 2003)
7. Inventory	Buffer mismatches between supply and demand	Storage of "excess demand" (Fitzsimmons and Fitzsimmons 2004; p. 429) "Transaction inefficient" customer (Xue and Harker 2002) "Customers in inventory" (Sampson 2001; p. 90)
8. Competitor	Provide choice and motivate producers	"Internal exchange(r)" (Lusch et al. 1992) "Competitor" (Bitner et al. 1997; Chervonnaya 2003) "decision maker" (Chervonnaya 2003)
Marketer	Generate additional sales	"Marketer" (Armistead 1986; Chervonnaya 2003) "Selling or marketing" (Normann 2000) "Advocate" (Graf 2007)
Consumer	Select, pay for, and consume the output	"Hunter" (Chervonnaya 2003) "Buyer" (Lengnick-Hall 1996, p. 807; Lengnick-Hall et al. 2000) "Recipients" (Lengnick-Hall et al. 2000) "User" (Lengnick-Hall 1996, p. 809)

include some that would be considered more service-like than others in order to provide variance that will help in the statistical analysis. Each subject could choose from three of the 72 businesses, and some businesses were targeted to get more responses if possible. This selection allowed subjects to choose a business they were familiar with and not select one they were less familiar with. Subjects were allowed to repeat the survey up to three times answering about a different candidate business each time.

Surveying a student population is appropriate for this study because we are focusing on B2C interactions within SSCs. Our study is not about beliefs or behaviors of any specific population. Instead we are studying a universalistic (theoretical) issue that we would expect to be manifest with any subject pool with sufficient knowledge (Stevens 2011). The students have extensive experience as consumers. The fact that they have limited work experience is beneficial in that it avoids bias that may come from working in a specific industry.

Service businesses and nonservice businesses were included to test the hypotheses positing that the eight customer roles exist to a greater degree in services. However, the literature suggests that the service nature of businesses is not a dichotomy, but that there are different types of services and the "serviceness" of business occurs in various degrees (Chase 1978; Shostack 1982; Schmenner 1986). We more precisely define the term "serviceness" as simply a continuous manifestation of the "service" distinction. For example, instead of saying that "healthcare is a service and auto manufacturing is not a service" we would say "healthcare exhibits a greater degree of serviceness than does auto manufacturing." The continuous nature of serviceness is not only consistent with concepts discussed in the literature, but also exhibited in our empirical data.

We ascertained the serviceness of the 72 candidate businesses according to a three-item SERVICE scale shown in Appendix A. Appendix B lists average SERVICE scores (and response counts) for each of the 72 businesses, showing that we were successful in including a variety of businesses that were more and less service-like (i.e., higher and lower degrees of serviceness).

The survey was initially developed on paper and administered electronically. Throughout the process, standard survey development procedures were followed, including pretesting and editing for item clarity, altering question ordering to avoid order bias, and so forth. Statistical results confirmed the quality of the survey data.

Data Reliability and Validity

In all, 842 subjects provided 1,380 usable completed surveys (some subjects evaluated two or three different businesses). Scale reliability statistics were very strong. The SERVICE scale had a Cronbach's alpha score of 0.912. The ordering of businesses according to SERVICE means (shown in Exhibit B) is reasonable and, with few exceptions, as we would have expected, indicating high face validity and suggesting that the scale is able to differentiate those considered to be service from those that are not. The three items of the SERVICE scale had a mean inter-item correlation of 0.733, suggesting convergent validity.

The customer-role scales also had high alpha scores, well above the traditional 0.70 reliability threshold, as shown in Table 2. Table 2 also lists correlations between each of the scales as well as mean inter-item correlations for each scale (bold terms on the diagonal). Those data demonstrate good construct validity: generally the items within each given scale had higher correlations with other items in the scale (convergent validity) than they did with items from other scales (discriminant validity). We included an artificial "customer as commodity" scale that had high reliability (alpha = 0.899) but insignificant correlation with the SERVICE scale, suggesting that we successfully avoided type II errors.

Table 2 demonstrates that there is some correlation between the customer roles, as we expected. Although the customer roles are distinct by definition, they are all based on customer involvement, so are likely to correlate. Factor analysis of the role scales (using maximum-likelihood extraction) revealed two factors explaining 60 percent of the variance, however the factor loadings did not reveal any insights.

Hypothesis Testing Results

We tested the hypotheses at the respondent level by correlations. Table 3 shows that scales for each of the eight customer roles correlate significantly with the SERVICE scale, confirming our hypotheses that the manifestation of expanded customer roles are more dominant when subjects consider the given business to be more service-like.

It is interesting to observe which customer roles were more significant. The customer-as-component-supplier role topped the list. Our other research has suggested that both practitioners and consumers perceive this customer-as-component-supplier phenomenon to be a major distinction of service businesses (Sampson and Snow 2011). Customer-as-product and customer-as-labor were close behind, representing two common ways customers are involved in SSCs.

This correlation analysis treats serviceness as an individual perception. Conversely, we can tie serviceness to each business and treat variation across subjects as measurement error. One way to test this is to split the sample by business (high SERVICE means versus low SERVICE means), and perform an unpaired t-test for each of the customer-role scales. Results are shown in

TABLE 2

Scale Statistics (N = 1380)

Scale	Alpha	Scale Correlations							
		Comp Supply	Labor	Des Eng	Prod Mgr	Prod	Qual Assure	Inven-tory	Comp-etitor
Component supplier	0.881	**0.713**	0.635	0.265	0.497	0.574	0.216	0.366	0.305
Labor	0.907	0.635	**0.711**	0.432	0.704	0.670	0.372	0.280	0.324
Design engineer	0.841	0.265	0.432	**0.637**	0.521	0.278	0.594	0.298	0.300
Production manager	0.841	0.497	0.704	0.521	**0.638**	0.493	0.454	0.280	0.321
Product	0.839	0.574	0.670	0.278	0.493	**0.562**	0.277	0.183	0.168
Quality assurance	0.783	0.216	0.372	0.594	0.454	0.277	**0.546**	0.217	0.211
Inventory	0.861	0.366	0.280	0.298	0.280	0.183	0.217	**0.605**	0.242
Competitor	0.854	0.305	0.324	0.300	0.321	0.168	0.211	0.242	**0.675**

Bold diagonal is mean inter-item correlations for each given scale.

TABLE 3

Test of Hypotheses (N = 1380). *Sorted highest to lowest*

Customer Role		Corr.*
H1:	Component supplier	0.499
H5:	Product	0.415
H2:	Labor	0.394
H4:	Production manager	0.277
H8:	Competitor	0.260
H7:	Inventory	0.244
H3:	Design engineer	0.151
H6:	Quality assurance	0.131

*Corr = Pearson correlations with SERVICE scale.
All correlations significant at a 0.01 level (2-tailed).

Appendix C. We found significant mean differences for all customer-role scales except for design engineer and quality assurance. A similar test that compares scale means for the top and bottom SERVICE quartiles show significant differences for all scales. We observe that expanded customer roles are distinctive of services under either type of analysis.

Test of Joint Effects

The UST defines services and SSCs according to customers having expanded roles by providing resources to production, specifically meaning production provided by a focal firm (see Figure 1). Each of the eight roles represents an example of customer-provided resources, with the exception of competitor. The customer-as-competitor effect is a consequence of customers providing key resources, allowing them to retain the resources and engage in do-it-yourself production (Sampson 2001, p. 202).

To test the power of customer roles in defining services, we regress all eight roles jointly on our SERVICE scale. The results are shown in Table 4. We recognize that the roles overlap, as illustrated in Table 2, which suggests that some degree of multicollinearity will exist. That multicollinearity may inflate standard errors of some regression coefficients, but will not detract from the quality of the overall fit.

These regression results show that all of the eight customer roles are manifest in services, but Table 4 suggest that four of the roles are the most uniquely defining: component supplier, product, competitor, and inventory. In fact, a model that only considers component supplier and product roles produces an adjusted R-squared of 0.273, which has almost as much predictive value as the model with all of the role variables. This suggests that component supplier and product roles are the most central to defining services.

Study Limitations and Future Research Opportunities

Our empirical study is of course limited by our selection of the 72 target businesses and choice of a

TABLE 4

Regression Results (N = 1380)

DV: SERVICE	
Constant term	1.202*
Customer role scale	*Beta*
Component supplier	**0.303***
Labor	0.052
Design engineer	−0.042
Production manager	−0.067
Product	**0.225***
Quality assurance	−0.009
Inventory	**0.084***
Competitor	**0.135***
Fit statistics	
R-squared	0.294
Adjusted R-squared	0.290
F statistic	71.366*

*Significant at <0.01 level. Others values not significant at <0.10 level.

subject pool. However, we argued above that students (primarily undergraduates) are experienced as consumers without being biased by excessive experience in any particular industry. As mentioned, for practical reasons this initial study focused on B2C service relationships, and expansion into B2B settings is in interesting topic for future research, and might involve in-depth case studies of customer involvement in specific B2B SSCs.

The UST defines services according to customer inputs, but does not restrict the nature of the requisite customer inputs. We have similarly assumed that all SSCs exhibit expanded customer roles, without restricting the nature of the customer roles, which may be considered a limitation. An interesting research question is whether some customer roles are manifested in some types of SSCs more than others, which can provide clues where corresponding design and management concerns will occur. As an initial example, in the next section we will consider differences in customer roles according to two common service typologies.

CUSTOMER ROLES WITHIN SERVICE TYPOLOGIES

There have been many service typologies proposed over the years. For example, Cook, Goh and Chung (1999) reviewed 39 service typologies published between 1964 and 1999. Space does not permit a broad review of customer roles within the various service typologies. We will focus on two service operation typologies that have been frequently cited over the past half-century: Chase's Customer Contact model and Schmenner's Service Process Matrix. (According to Google Scholar, Chase's original 1978 article has been cited 763 times at this writing, and Schmenner's original 1986 article has been cited 570 times.)

Roles in Chase's Customer Contact Service Typology

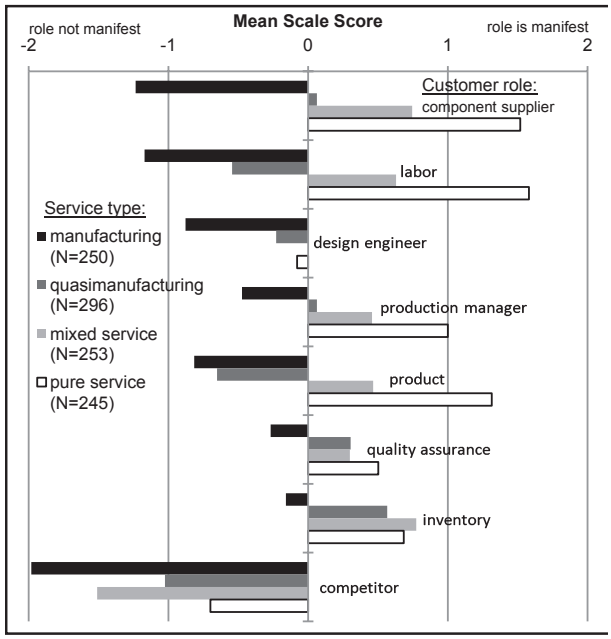
Chase's service typology divides service businesses into four categories according to "the degree of customer contact" (from low to high): manufacturing, quasimanufacturing, mixed service, and pure service. Chase defines customer contact as "the physical presence of the customer in the service system" which he correlates with "the degree of interaction between [the service system and the customer] during the production process" (Chase 1978, p. 138). In a separate survey, we asked similar subjects to evaluate 70 of the 72 businesses according to the following three-item INTERACTION scale (same response format as other scales):

- [Auto repair] involves a lot of interaction with customers (car owners).
- Interacting with customers (car owners) is a key element of [auto repair].
- A lot of the work time in [auto repair] is spent interacting with customers (car owners).

As with the customer-roles survey, we allowed subjects to choose from among the 70 businesses. We received 1,332 usable responses, with good statistics for scale validity and reliability (alpha = 0.912). Again, subjects chose some of the businesses more than others. After eliminating businesses with response counts of less than 12, we divided the remaining 45 businesses according by INTERACTION scale quartiles, with the lowest quartile corresponding to Chase's "manufacturing" category and the highest quartile being "pure services." We then calculated mean scores for the customer-role scales according to all four of Chase's categories. The results are summarized in Figure 3.

Eleven businesses were in the lowest quartile (manufacturing), representing 250 of the 1380 customer-roles survey responses. The black bar at the top of Figure 3 shows the mean (−1.235) for the customer–supplier scale across those 250 responses, implying that the customer–supplier role was not strongly manifest for the firms categorized as manufacturing. The solid white bar to the right indicates that the customer–supplier role was strongly manifest for the eleven firms categorized as pure services. The gray bars

FIGURE 3
Customer Roles Manifest in Chase's Service Categories



are for the two intermediate categories: quasimanufacturing and mixed services.

As we might expect, the manifestation of the roles increases across Chase's four categories, implying that the roles track with increased customer interaction. The mean scale scores for all customer roles were negative for the businesses categorized as manufacturing. It is interesting to observe that four of the customer-role scales showed consistently increasing manifestations across the four categories of businesses (component–supplier, labor, production manager, and product). The other four scales showed increases across the four categories, but in a less consistent manner (although differences across business types were statistically significant).

Chase reviewed various managerial implications of his customer-contact categorization. The way in which customer roles vary across Chase's categories can provide additional insights into managerial issues occurring for different types of services, which we leave to future research.

Roles in Schmenner's Service Process Matrix

Schmenner (1986) developed a Service Process Matrix that is somewhat analogous to the traditional Product-Process Matrix of manufacturing (Hayes and Wheelwright 1984, p. 209). Schmenner's matrix (shown in Table 5) divides service businesses into four categories according to two dimensions: (1) degree of interaction and customization, and (2) degree of labor intensity. The first dimension is similar to Chase's interaction dimension, but also includes an element of customization. Schmenner defines labor intensity as "the ratio of labor costs incurred to the value of plant and equipment," which can be taken as an inverse representation of the degree to which a service is mechanized or automated.

TABLE 5

Schmenner's (1986) Service-Process Matrix

Degree of Labor Intensity	Degree of Interaction and Customization	
	Low	*High*
Low	Service Factory (e.g., airlines)	Service Shop (e.g., auto repair)
High	Mass Service (e.g., schools)	Professional Service (e.g., architects)

Categorizing the 72 businesses according to Schmenner's typology is more difficult than with Chase's one-dimensional model. Although we have data on the degree of interaction for many of the businesses (as described above), we have no data on the degree of customization (although Schmenner treats them as being correlated). Determining labor intensity would require access to industry cost structure data, which is beyond the scope of this research (In 2004, Schmenner replaced the labor intensity axis with "relative throughput time," which may even be more daunting to estimate.). Therefore, we fit our 72 businesses into Schmenner's typology according to examples listed in his original treatises (Schmenner 1986).

Unlike Chase, Schmenner only categorizes service businesses, so we selected the 34 businesses that were clearly services (with SERVICE scores that are positive and nonzero at a $p < 0.1$ significance level). We categorized the 34 service businesses according to examples given in Schmenner's 1986 article, as follows (Numbers in parentheses show how many of the 34 businesses fit that category, and the number of survey responses for those businesses.):

- Service Factories (six businesses, 107 responses): airlines, busses, entertainment (considered similar to recreation).
- Service Shops (six businesses, 160 responses): hospitals (surgery), auto repair, plumbing (other repair), restaurants (see Schmenner 1986 Figure 3).

- Mass Services (five businesses, 106 responses): retailing, real estate sales, schools, travel agents, banking (investment management).
- Professional Services (eight businesses, 126 responses): doctors, lawyers, accountants, architects; also included consultants.

The other nine service businesses were not tightly related to examples given by Schmenner, so were not categorized. Customer-role scale scores were calculated for each of the roles across each of the four categories. Table 6 lists the roles that were positively manifest and statistically significant ($p < 0.05$), ordered from highest to lowest scale mean.

Service Factories showed the least manifestation of customer roles, with two relatively passive roles being manifest: inventory and product. This suggests that management of Service Factories might focus on keeping customers moving efficiently through the production system. It is notable that inventory was a significant customer role for all four categories, emphasizing the universal importance of managing customer waiting.

The significant customer roles in Mass Services and Professional Services were identical, with a slight difference in ordering. Those types of services manifest all customer roles except for design engineer and competitor, which were not significant for any of the categories. Design engineer and competitor did correlate with SERVICE, but were not as common as other roles among this subsample of businesses. For Service Factories, Service Shops, and Professional Services the competitor customer role was statistically significant ($p < 0.01$) but negative, suggesting that customers are not likely to compete in these chosen businesses.

TABLE 6

Customer Roles Manifest in Service-Process Matrix Categories *(Roles sorted from highest to lowest mean scale scores)*

In Service Factories	In Service Shops
Inventory	Component supplier
Product	Inventory
	Production manager
	Quality assurance
In Mass Services	**In Professional Services**
Labor	Component supplier
Component-supplier	Labor
Production manager	Product
Product	Production manager
Inventory	Inventory
Quality assurance	Quality assurance

This analysis is limited by the selection of businesses that correspond to the Service-Process Matrix categories, and other businesses were left out because they did not easily fit into that matrix. Again, the purpose is simply to illustrate how the customer roles may be manifested differently for different types of services, with in-depth typological analysis being a topic for other research. For example, recent research on professional services (Lewis and Brown 2012) indicates that, even within what would appear to be a clear-cut professional service — law — the range of process types is quite broad.

IMPLICATIONS FOR SSC INNOVATION

Our knowledge about the expanded customer roles in SSCs can lead to important managerial insights. In this section, we will briefly focus on one area of insight: the ways in which the expanded customer roles can guide innovation in services and SSCs. In particular, we argue that the eight distinct roles provide a structured way to explore changes to SSC designs.

Traditional supply chains are replete with innovations ranging from high-tech RFID inventory tracking to low-tech strategic partnerships. Bitner, Ostrom and Morgan (2008, p. 66) assert that " … innovation in services is less disciplined and less creative than in the manufacturing and technology sectors." They further state, "A recent comprehensive review of the academic literature on product innovation also reveals little explicit coverage of research on service innovation." They suggest that " … lack of widespread and disciplined innovation in services derives at least partially from the nature of services themselves."

SSC innovation has been discussed in the literature under the title of new service development (NSD). For example, Froehle and Roth (2007) develop a "Resource-Process Framework," to link the organization's resources with its process for developing new services. Indeed, Roth and Menor (2003) saw NSD as an important part of a broader view of strategy which, at the conceptual level, involves linking target market with service concept and appropriate service delivery system (i.e., SSC). More recently still, the product innovation literature is turning its attention to the similarities and differences between new product development processes and NSD processes (Ettlie and Rosenthal 2011; Schleimer and Shulman 2011), highlighting the less structured approach typical of NSD and exploring the distinctive nature of collaboration in NSD.

What we propose here complements these contributions by providing some guidelines for systematically examining innovation opportunities coming from the role structure of SSCs. In this, we are indebted to the

work of Normann, who show how to constantly and critically question the form a service offering might take (see Normann 2001, Normann and Ramırez 1993). Building further on the UST, we suppose that while customer involvement may complicate SSC innovation, it may also lead to opportunities for innovation — by altering the customer roles (Sampson 2012). In other words, if SSCs differ from traditional supply chains largely in expanded customer roles, then unique aspects of service innovation are likely to pertain to devising means for changing the customer roles.

SSC Innovation by Shifting Customer Roles

In this section, we take automobile repair and maintenance as an illustrative example of how service innovation might be generated by considering each of the SSC customer roles in turn. We consider both *enhancing* and *reducing* each of the roles as potential opportunities for SSC innovations (Normann and Ramírez 1993). We do not claim that the service innovations we identify are new to the world — many, if not all, exist already — but we use them to show how this approach could be used to generate innovations around an existing SSC configuration, in a systematic and fine-grained way.

Table 7 summarizes the basic idea and the results that might be generated by applying it to this simple, familiar example. We consider as the base case the SSC customer to be an automobile owner with a modest degree of expertise in diagnosing and repairing faults, who pumps his own gas and carries out routine maintenance such as topping off oil and maintaining tire pressures. From this base case, we suggest, for each role, a change in the service offering that enhances that customer role and one that reduces it. By extension, we then suggest that, for any SSC, this same approach can be used to generate possible innovations.

Strategic Implications of Shifting Roles

Shifts in service design such as those outlined in Table 7 are clearly strategic moves, in the sense of the classic strategy trade-offs. For example, the extent to which the work is carried out for the customer and minimizes inconvenience for him/her (customer–labor role) has cost/price and quality implications. Different SSC designs might be used in combination to manage capacity. For example, student counseling (counseling showed one of the highest customer–labor roles in the survey) typically has large peaks in demand at the start of the year and during examination periods: this is managed by providing preemptive lectures, leaflets, and online FAQs on worrisome issues — for example, exam technique. In other words, the customer-as-component-supplier role is reduced, and the customer-as-labor role is proportionately increased.

If the examples in Table 7 are considered, it will be apparent that the appropriate level of many of the service roles depends on the capabilities of the customer. Certainly in this case, it is only an especially knowledgeable customer that could take an enhanced design engineer role, for example. There is also often a shift in the distribution of risk. Take the customer–labor role: a customer carrying out more repairs themselves, even guided by a remote expert advisor, may save money, but is likely to shoulder the burden of risk if the repair goes wrong. Notice also that some of the customer-enabling shifts involve the sale of products in place of services: for example, kits for self-administered oil changes in place of an oil-change service. Finally, notice the customer–product role. In this case, the service is primarily intended to act on customers' possessions (their autos), but could be extended and adapted to act on the customers' minds and bodies, so that they become the product as well.

Implications for the Wider Supply Network

The critical insight on which this analysis is based is that in services, customers act as resource suppliers (Sampson 2000). In some sense, then, any service involving two entities is already a supply chain — that is, comprising a supplier, a producer and a customer, albeit that the supplier and the customer happen to be the same entity. But the shifts in service roles within the supplier-customer dyad discussed here also potentially have implications in the wider network (Sampson 2012). To return to the auto repair example in Table 7, the various moves that replace provider-customer interaction with the customer's do-it-yourself (DIY) effort — using self-help manuals, oil-change kits and the like — require the service provider to mobilize suppliers of kits, instruction materials and, indeed, to work on designing their service know-how into products. (The same can be said for the student counseling service mentioned previously, which would draw on the services of leaflet and website designers and suppliers.) Indeed, technology can be used in various ways to replace the service know-how of both customers and the focal firm. The example of the intelligent tire inflation machine requires machine suppliers to establish a supply network for the updating of the machine as new tire and auto models are produced. More generally in auto repair, the diagnostic know-how of auto shop staff has to some extent been replaced by sophisticated software that works in conjunction with the engine management systems of contemporary automobiles.

Conversely, the shifts toward reduced customer–labor and customer–competitor roles often, in this industry, give rise to multi-firm networks of service

TABLE 7

Shifting Customer Roles — Auto Repair and Maintenance Example

SSC Customer Role	"Typical" Base Case Role	Enhanced Role	Reduced Role
Component supplier	Customer brings auto to the garage with vague description of symptoms of fault	Expert customer provides extensive diagnostic information when repairs needed	Customer does not provide anything to provider, but does repairs using self-help manual
Labor	Customer drives auto to garage for repairs, also pumps gas, inflates tires and fills oil on routine basis	Expert advisor talks customer through self-administered repair	Garage tows/collects car from customer's home as well as doing repair work
Design engineer	Customer exercises some choice, for example, brand or specification of replacement tires	Classic car enthusiast knows more than the garage about the precise specification required	Leaves all repair planning to the discretion of the auto shop
Production manager	Customer manages the schedule for routine auto maintenance (oil change, tire rotations, etc.)	Customer books maintenance times online, buying a certain number of hours' labor upfront	Garage handles all routine maintenance, calling customer to schedule all maintenance activities
Product	During repairs, customer is provided with face-to-face progress report and cost estimates, and perhaps a cup of coffee and/or doughnuts	Repair customers could be advised/trained on practices to reduce need for repair, for example, excessive braking leading to brake wear	Customers were required to provide minimal information online and experience no interaction or contact with garage staff
Quality assurance	After repair work, customers see that vehicle works properly in normal use	Customers watch repairs being conducted and provide feedback	Intelligent tire inflation machine reads RFID chip on tire and auto and "knows" the correct pressure, removing the need for customer QA of their own work
Inventory	Some waiting in line when dropping car off for repair and collecting it	Repair-while-u-wait as basic design of service (e.g., Kwik-Fit in UK)	Comprehensive collection and courtesy car provision to minimize waiting and inconvenience
Competitor	Customer pumps own gas, inflates tires, refills coolant, cleans car inside and out	Provision of kits and instructions for common tasks, for example, oil change	Take over minor routine tasks such as pumping up tires, washing and valeting car as part of total service package

providers such as dealers, repair shops, towing operators, rental firms and insurers, who provide different elements of the "total solution," minimizing inconvenience for the customer (at a price) (Normann and Ramírez 1993). Such arrangements require effective information systems to link together the capacities of the various providers, and to ensure that all the interfirm payments are made according to established contracts.

SUMMARY

We demonstrated the distinctiveness of SSCs by describing eight distinctive SSC customer roles from the literature. Hypotheses about the distinctiveness of the eight customer roles were tested and supported by an empirical survey. We showed how the customer roles were manifest across two popular service typologies. By the use of an illustrative example, then, we

demonstrate how the eight roles can be used as a basis for SSC innovation. This approach allows strategic design of SSCs according to the expanded customer roles, considering their capabilities in the various roles, their interest in process control, their willingness to spend, and so forth. It also points to options for the management of the focal firm's capacity. We also outline ways in which shifting the roles between the focal firm and the customer links with the wider supply network.

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APPENDIX A

SURVEY SCALE ITEMS

Each subject was given these items reworded to cover one of the 72 businesses shown in Appendix B. For example, the first item of the SERVICE scale is "<Name of business> is a service business." The scale items are shown below for the survey about "repairing cars" by "mechanics" for "car owners."

Scale	Scale Items (7-point "Strongly Disagree" to "Strongly Agree")
SERVICE	Repairing cars is a service business. Repairing cars is in a service industry. Repairing cars primarily involves providing services to car owners.

Customer Role	Scale Items (7-point "Strongly Disagree" to "Strongly Agree")
1. Component supplier	Repairing cars involves working on something provided by customers (car owners). The process of repairing cars depends upon customers (car owners) first providing something for the mechanics to work on. Mechanics cannot do the work of repairing cars unless customers (car owners) first provide themselves, or something that belongs to them, or their information.
2. Labor	The process of repairing cars involves customers (car owners) working together with mechanics. Repairing cars generally involves effort from customers (car owners) as well as the effort of mechanics. Customers (car owners) work with mechanics in the process of repairing cars. Customers (car owners) actively participate with mechanics in the process of repairing cars.

Continued.

APPENDIX A (Continued)

3. Design engineer	Customers (car owners) provide mechanics with suggestions about how the mechanics should perform the process of repairing cars. Mechanics often receive information from customers (car owners) about how they should go about repairing cars. Repairing cars often involves customers (car owners) telling mechanics how the mechanics should do their jobs.
4. Production manager	Customers (car owners) are somewhat responsible for directing the process of repairing cars. In the process of repairing cars, customers (car owners) are somewhat responsible for directing the work which is being done. The work of repairing cars is somewhat directed by customers (car owners).
5. Product	In repairing cars, customers (car owners) themselves are part of the product. Customers (car owners) often feel like they are part of the product of repairing cars. The process of repairing cars involves customers (car owners) themselves as part of what is being produced. Repairing cars involves mechanics acting upon customers (car owners).
6. Quality assurance	Customers (car owners) are regularly asked by mechanics about how good the mechanics are doing at repairing cars. Mechanics look to customers (car owners) for information about how well the mechanics are doing at repairing cars. One role of customers (car owners) in the process of repairing cars is to provide mechanics with assessments of quality of the mechanics' work.
7. Inventory	It is common for customers (car owners) to have to wait for mechanics while the mechanics are repairing cars. The process of repairing cars often involves customers (car owners) waiting for mechanics to do their job. With repairing cars, customers (car owners) often have to wait for the mechanics to do their job. With repairing cars, customers (car owners) are often less satisfied with mechanics because they have to wait for the mechanics to do their job.
8. Competitor	Customers (car owners) who are not satisfied with mechanics who are repairing cars can reasonably do it on their own for themselves. Customers (car owners) who are dissatisfied with the way mechanics are repairing cars can reasonably handle repairing cars for themselves. Mechanics sometimes lose business to customers (car owners) who decide to handle repairing cars for themselves.

APPENDIX B

CANDIDATE BUSINESSES

SERVICE scales statistics shown for each business (total N = 1380).

Mean	St. Dev	Business Description
2.750	0.537	Guiding tours by tour guides for tourists (N = 16)
2.736	0.428	Planning travel by travel agents for travelers (N = 24)
2.625	0.643	Completing personal income tax returns by accountants for taxpayers (N = 16)
2.619	0.756	Managing investments by stock brokers for individual investors (N = 7)

Continued.

APPENDIX B (Continued)

2.524	0.466	Driving busses by bus drivers for riders (N = 7)
2.487	0.641	Dry cleaning laundry by dry cleaners for consumers (N = 26)
2.481	0.551	Transporting passengers by airlines for travelers (N = 18)
2.467	0.631	Cleaning teeth by dental hygienist for patients (N = 25)
2.462	0.806	Treating illnesses by physicians for patients (N = 26)
2.452	0.802	Counseling by psychologists for patients (N = 28)
2.389	0.574	Flying airplanes by pilots for travelers (N = 6)
2.389	0.725	Auditing financial records by accountants for client firms (N = 18)
2.379	0.956	Management consulting by consultants for client firms (N = 22)
2.333	0.558	Enforcing laws by police departments for citizens (N = 6)
2.321	1.209	Repairing automobiles by mechanics for car owners (N = 28)
2.292	0.929	Serving food by restaurants for consumers (N = 24)
2.235	0.851	Painting cars by paint shops for car owners (N = 27)
2.200	0.606	Defending criminals by defense lawyers for defendants (N = 5)
2.167	0.954	Teaching by teachers for students (N = 28)
2.143	0.716	Administering government programs by government organizations for citizens (N = 7)
2.139	0.916	Showing movies by movie theaters for movie goers (N = 24)
2.107	1.217	Performing surgery by surgeons for patients (N = 28)
2.095	0.937	Information systems consulting by consultants for client firms (N = 7)
2.051	1.267	Cooking food by restaurants for consumers (N = 26)
1.975	1.223	Installing plumbing fixtures by plumbers for home owners (N = 27)
1.929	1.138	Selling real estate by real estate agents for home buyers (N = 28)
1.875	1.198	Giving live musical performances by musicians for audiences (N = 16)
1.859	0.929	Defending citizens by military organizations for citizens (N = 26)
1.857	1.152	Protecting citizens by police departments for citizens (N = 7)
1.772	1.144	Cashiering by cashiers for consumers (N = 19)
1.720	1.035	Designing homes by architectural firms for people building homes (N = 25)
1.714	1.239	Arguing cases by trial lawyers for plaintiffs (N = 7)
1.713	1.161	Broadcasting sports events by television stations for viewers (N = 36)
1.574	1.119	Producing electricity by power companies for consumers (N = 18)
1.505	1.505	Selling real estate by real estate agents for home sellers (N = 31)
1.333	1.414	Selling retail items by retailers for consumers (N = 7)
1.333	1.354	Leasing new cars by auto dealerships for consumers (N = 5)
1.222	1.159	Broadcasting sports events by television stations for advertisers (N = 30)
1.190	1.720	Patrolling highways by highway patrol officers for citizens (N = 7)
1.167	1.479	Broadcasting sports events by television stations for sports team owners (N = 18)
1.000	1.665	Designing automobiles by automotive engineers for auto companies (N = 24)
0.987	1.648	Making custom wood furniture by furniture companies for consumers (N = 25)
0.975	1.508	Building homes by builders for families (N = 27)
0.952	1.880	Competing in sports by professional athletes for spectators (N = 7)
0.949	1.444	Developing software for sale through retailers by software engineers for software users (N = 26)
0.933	1.116	Drafting laws by government legislatures for citizens (N = 5)
0.905	1.084	Paving roads by construction crews for cities (N = 7)
0.864	1.497	Composing music by musicians for listening consumers (N = 27)

Continued.

APPENDIX B (Continued)

0.852	1.424	Building commercial properties by builders for tenant organizations (*N* = 18)
0.804	1.253	Selling new cars by auto dealerships for consumers (*N* = 17)
0.784	1.514	Building custom homes by builders for families (*N* = 17)
0.727	1.525	Acting in theater by actors for live audiences (*N* = 22)
0.705	1.752	Recording music by musicians for listening consumers (*N* = 26)
0.680	1.591	Painting cars by auto companies for consumers (*N* = 25)
0.644	1.211	Printing newspapers by news publishers for readers (*N* = 15)
0.642	1.656	Acting in movies by actors for movie goers (*N* = 27)
0.500	1.380	Developing pharmaceuticals by drug companies for consumers (*N* = 8)
0.487	1.853	Building housing developments by builders for families (*N* = 26)
0.333	1.934	Coaching college sports by coaches for spectators (*N* = 7)
0.286	1.789	Designing clothing by fashion designers for consumers (*N* = 7)
0.188	1.463	Painting fine art by artists for art collectors (*N* = 23)
0.179	2.144	Farming by farmers for food consumers (*N* = 28)
0.147	1.800	Producing food items by food processors for consumers (*N* = 25)
−0.311	1.545	Writing novels by authors for readers (*N* = 15)
−0.370	1.843	Logging by lumber companies for lumber users (*N* = 27)
−0.395	1.617	Printing books by book publishers for book readers (*N* = 27)
−0.479	1.882	Making movies by movie producers for movie goers (*N* = 16)
−0.825	1.922	Mass producing wood furniture by furniture companies for retail consumers (*N* = 19)
−0.962	1.604	Refining fuels by oil companies for consumers (*N* = 26)
−1.069	1.733	Mining diamonds by mining companies for jewelry producers (*N* = 24)
−1.200	1.070	Coaching professional sports by coaches for spectators (*N* = 5)
−1.500	1.692	Producing automobiles by auto companies for consumers (*N* = 26)

APPENDIX C

SCALE STATISTICS

Businesses split on SERVICE median.

	All Businesses (72 Businesses, 1380 Responses)		Low SERVICE (35 Businesses, 701 Responses)		High SERVICE (37 Businesses, 679 Responses)			
Scale	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean Diff.	Mean Diff. Signif.
SERVICE	1.244	1.700	0.320	1.758	2.140	1.033	1.821	<0.001
Component supplier	0.405	1.840	−0.518	1.662	1.300	1.538	1.818	<0.001
Labor	0.288	1.671	−0.234	1.651	0.795	1.530	1.029	<0.001
Design engineer	−0.155	1.499	−0.178	1.519	−0.133	1.481	0.046	0.573
Production manager	0.370	1.471	0.074	1.514	0.658	1.369	0.584	<0.001
Product	0.157	1.516	−0.300	1.399	0.599	1.495	0.900	<0.001
Quality assurance	0.238	1.385	0.238	1.388	0.239	1.384	0.001	0.993
Inventory	0.541	1.464	0.240	1.517	0.833	1.348	0.593	<0.001
Competitor	−1.147	1.554	−1.655	1.232	−0.655	1.673	1.000	<0.001